Helpful Tools

Ring Test R-3
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Maximum Exposure Angles R-22
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Notes

Ring Test

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A ring test should be performed before mounting an abrasive wheel. This test is simple and can help determine if the wheel is cracked.

Limitations:

The wheel has to be dry and free of sawdust when applying the ring test, otherwise the sound may be deadened.

The ring test doesn't work with certain wheels because of their shape or size.

Examples include:

- Wheels 4 inches diameter and smaller
- Plugs and Cones
- Mounted Wheels
- Segments
- Plate-Mounted Wheels
- Inserted Nut and Projecting Stud Disc Wheels

How to do the test:

1) Suspend the wheel by putting a small pin or your finger through the arbor hole in the wheel. Heavier wheels may be allowed to rest in a vertical position on a clean hard floor (See Heavy wheel illustration).
2) Tap the flat side of the wheel with a light non-metallic implement, such as the handle of a screw driver, at a point
   - 45 degrees from the vertical center line on each side of the wheel (See Light wheel Illustration)

     and
   - 1 – 2 inches from the edge of the wheel. Large, thick wheels may be struck on the periphery rather than the side of the wheel.
3) Rotate the wheel 45 degrees and repeat the test until the entire wheel has been checked.

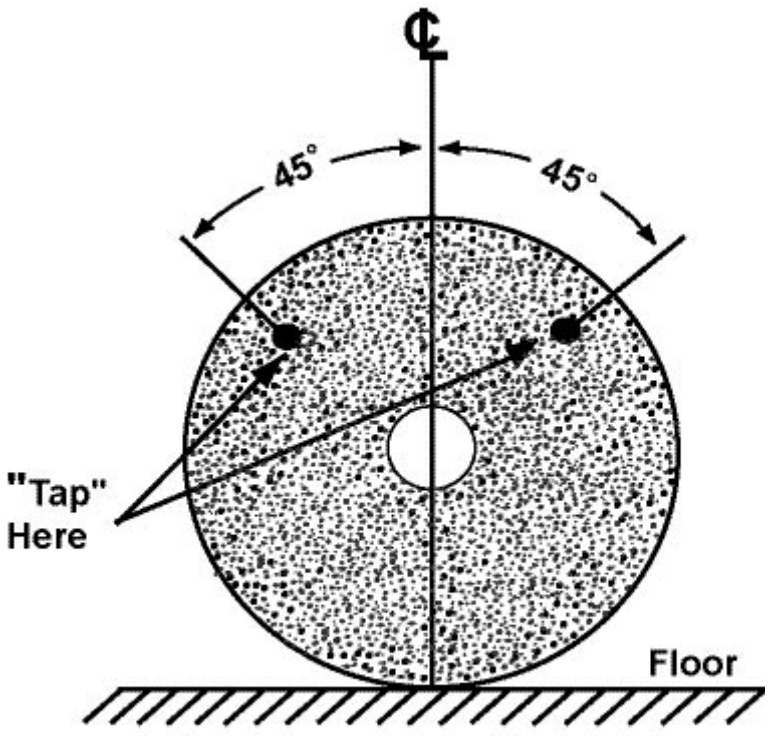
-Continued-

Ring Test (continued)

How to use the results:

The ring test depends on the fact that a crack in the wheel will normally change the sound emitted when the wheel is lightly tapped. An undamaged wheel will give a clear tone. If cracked, there will be a dead sound and not a clear ring.

Comparison of the sound with other wheels of the same lot and specification will allow rejection of any wheel with a suspiciously different ring.



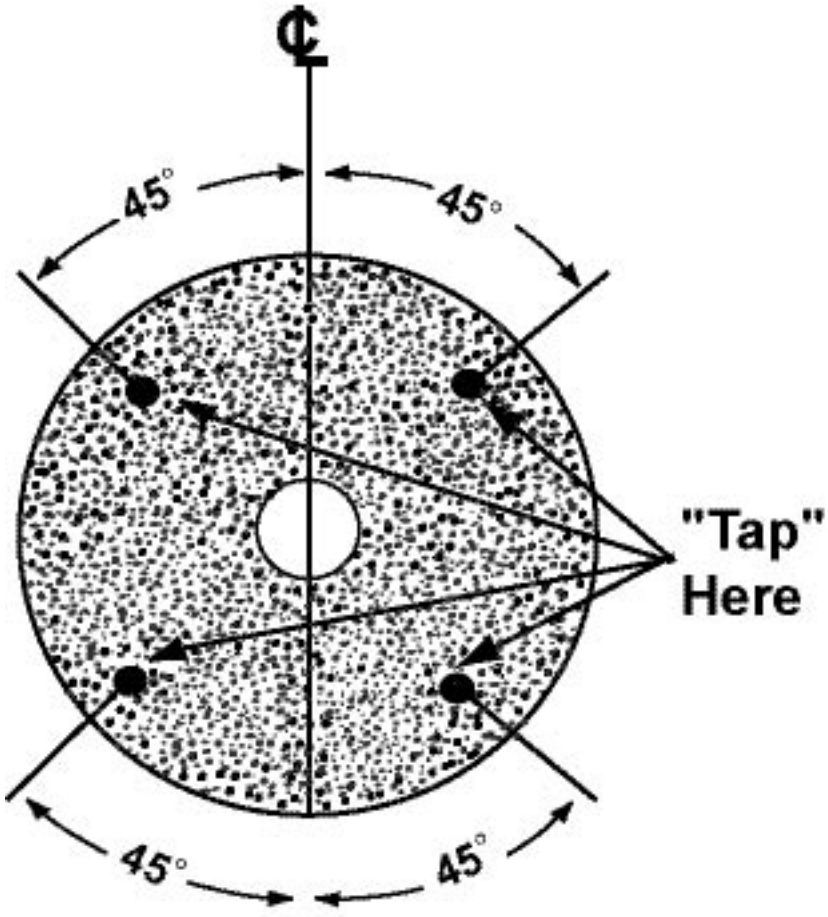
Heavy Wheels

-Continued-

Ring Test

Use with Machine Safety, Chapter 296-806 WAC

Ring Test (continued)



Light Wheels

Resources

Notes

Abrasive Wheel Illustrations

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types

This tool contains illustrations of:

- Some specific types of wheels used in this chapter
- General types of flanges used with abrasive wheels
- Mounting of some specific types of wheels
- Maximum exposure angles for safeguarding specific wheels.

Many of the illustrations include definitions to help familiarize you with this type of wheel.

You will find these illustrations in this tool:

Type 1 Wheel R-9

Type 6 Wheel R-10

Type 11 Wheel R-11

Type 27 and 27A Wheels R-12

Type 28 Wheel R-13

Type 29 Wheel R-14

Modified Type 6 and 11 Wheels (Terrazzo) R-15

Mounted Wheels R-16

Cone and Plug Wheels R-17

General Types of Flanges R-18

Mounting Wheels R-20

Mounting Threaded Hole Wheels R-21

-Continued-

Resources

Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

You will find illustrations of these maximum exposure angles in this tool:

Bench, Pedestal, and Floorstand Grinders R-23

Bench, Pedestal, and Floorstand Grinders with Contact Below the Level of the Spindle R-23

Cylindrical Grinder R-24

Bench, Pedestal, Floorstand, and Cylindrical Grinder Exposure Angle Adjustment R-24

Surface Grinders and Cutting-off Machines R-25

Swing Frame Grinders R-25

Top Grinding R-26

Abrasive Wheel Illustrations - Wheels

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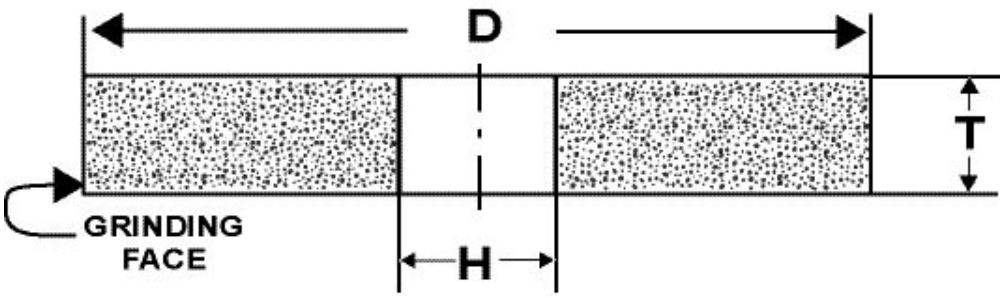
Abrasive Wheel Illustrations - Wheel Types (continued)

Type 1 wheel

An abrasive wheel that is shaped like a disc with a mounting hole in the middle. Sometimes called a “straight wheel.” It has diameter (D), thickness (T), and hole size (H) dimensions. Grinding is normally done on the periphery (outside curve) of the wheel (T dimension).



TYPE 1 - STRAIGHT WHEELS

-Continued-

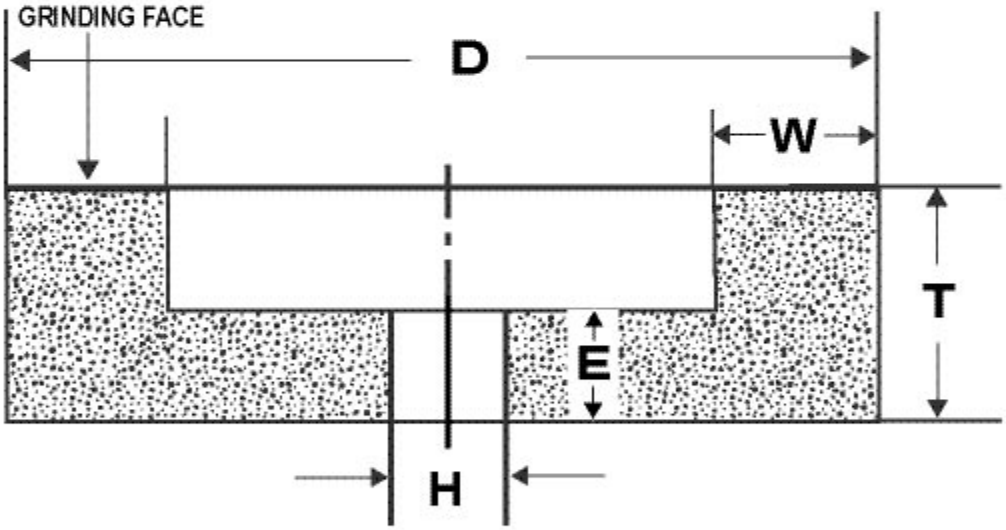
Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

Type 6 wheel

An abrasive wheel that is shaped like a straight-sided cup or bowl with a mounting hole in the bottom of the cup. Sometimes called a "cup wheel." It has diameter (D), thickness (T), hole size (H), rim thickness (W), and back thickness (E) dimensions. Grinding is normally done on the cup rim (W dimension).



Type 6 Straight Cup Wheel

-Continued-

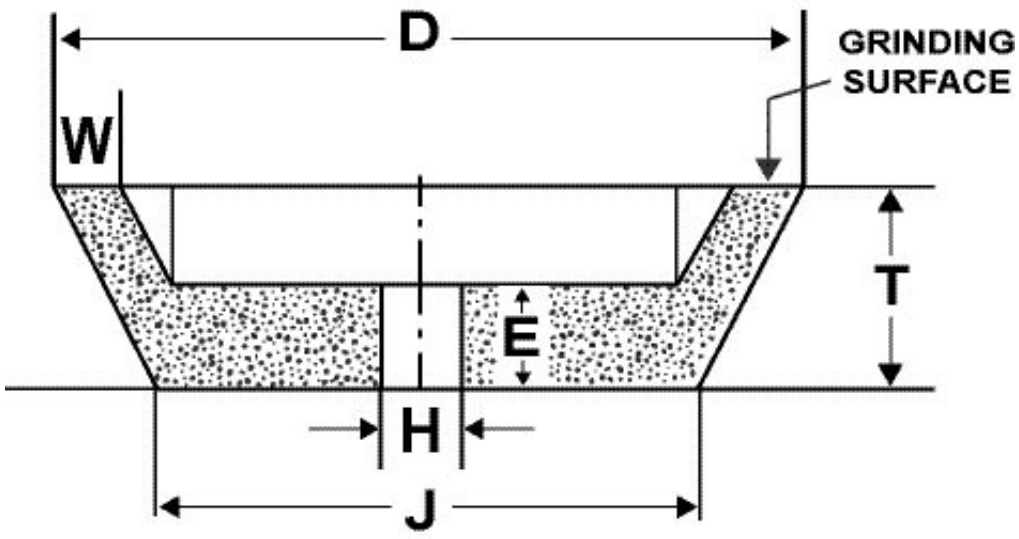
Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

Type 11 wheel

An abrasive wheel that is shaped like a cup or bowl with a mounting hole in the bottom of the cup. The sides of the cup are not straight-sided but are angled outward. Sometimes called a "flaring cup wheel" since the sides are "flared" out. It has double diameter dimensions (top D and bottom J). It also has thickness (T), hole size (H), rim thickness (W) and back thickness (E) dimensions. Grinding is normally done on the cup rim (W dimension).



TYPE 11 - FLARING CUP WHEEL

-Continued-

Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

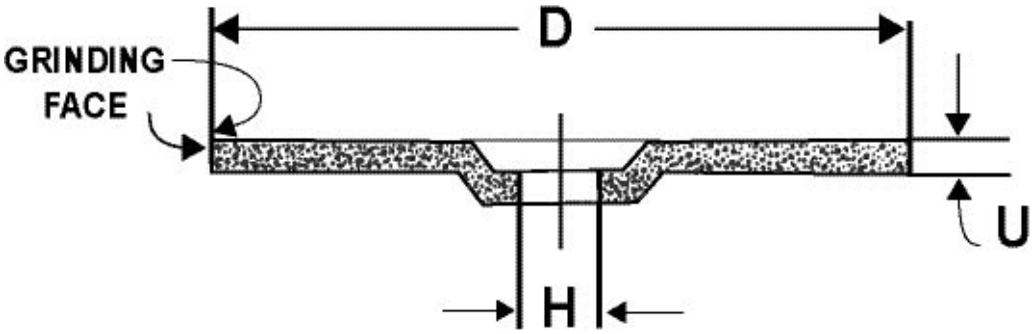
Abrasive Wheel Illustrations - Wheel Types (continued)

Type 27 wheel

An abrasive wheel that is similar to a Type 1 wheel, but the center of the wheel around the mounting hole is pushed back (depressed). Sometimes called a "depressed center" wheel. It has diameter (D), thickness (U) and hole size (H) dimensions. The depressed center allows grinding on the flat surface of the wheel without interference from the flange or mounting hardware.

Type 27A cutting-off wheel

Similar to a Type 27 wheel. Specifically designed for use on cutting-off machines.



Type 27 and 27A Wheels

Note:

- Type 27 wheels are manufactured with flat grinding rims or faces and are designed for:
  - Side grinding when held at a slight angle to the workpiece
  - Peripheral grinding, including small cutting-off and shallow notching operations
- Type 27 wheels may be used flat when grinding masonry and concrete surfaces such as ceilings and walls.

-Continued-

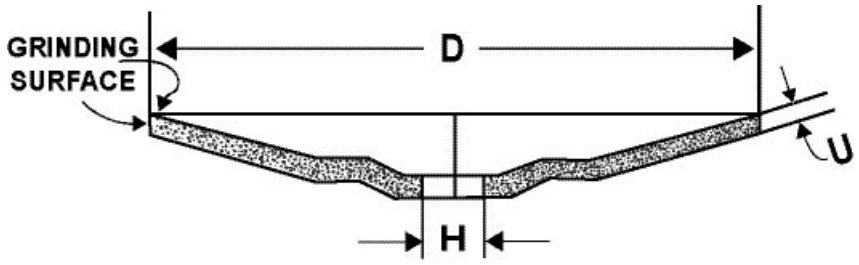
Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

Type 28 wheel

An abrasive wheel that is similar to a Type 27 wheel, but the face of the wheel is angled upward and away from the mounting hole. The face of a Type 27 wheel is flat and perpendicular to the mounting hole. A Type 28 wheel is also called a "depressed center" wheel. It has diameter (D), thickness (U) and hole size (H) dimensions. The depressed center allow grinding without interference from the mounting. A Type 28 wheel has a saucer-shaped grinding rim and is designed for corner grinding and side grinding.



Type 28 Wheel

-Continued-

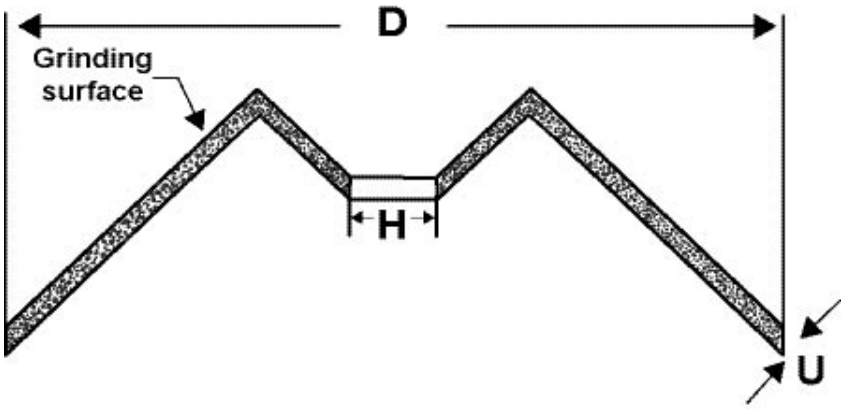
Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

Type 29 wheel

An abrasive wheel that has reversed, saucer-shaped grinding rims (similar to a partially opened umbrella). It has diameter (D), thickness (U) and hole size (H) dimensions.



Type 29 Wheel

-Continued-

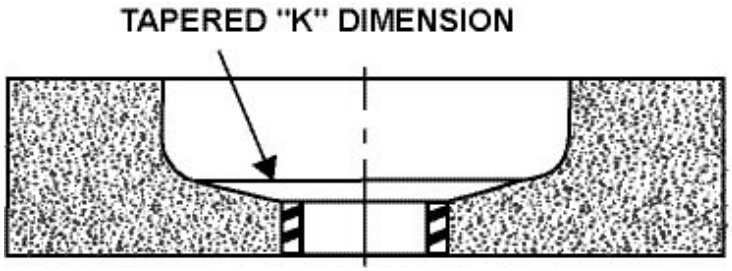
Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

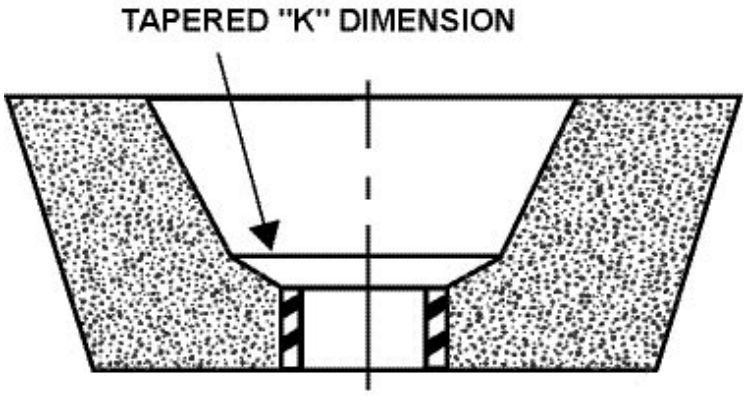
Abrasive Wheel Illustrations - Wheel Types (continued)

Modified Type 6 and 11 wheels (Terrazzo)

Similar to Type 6 “straight cup” wheels and Type 11 “flaring cup” wheels except for the bottom of the cup. The bottom of the cup is flat in Type 6 and 11 wheels. The modified wheels have bottoms that are sloped downwards towards the mounting hole. These modified wheels need to be mounted using a special tapered flange furnished by the tool manufacturer. These wheels are used in the terrazzo trade.



TYPE 6 WHEEL (TERRAZZO)



TYPE 11 WHEEL (TERRAZZO)

-Continued-

Resources

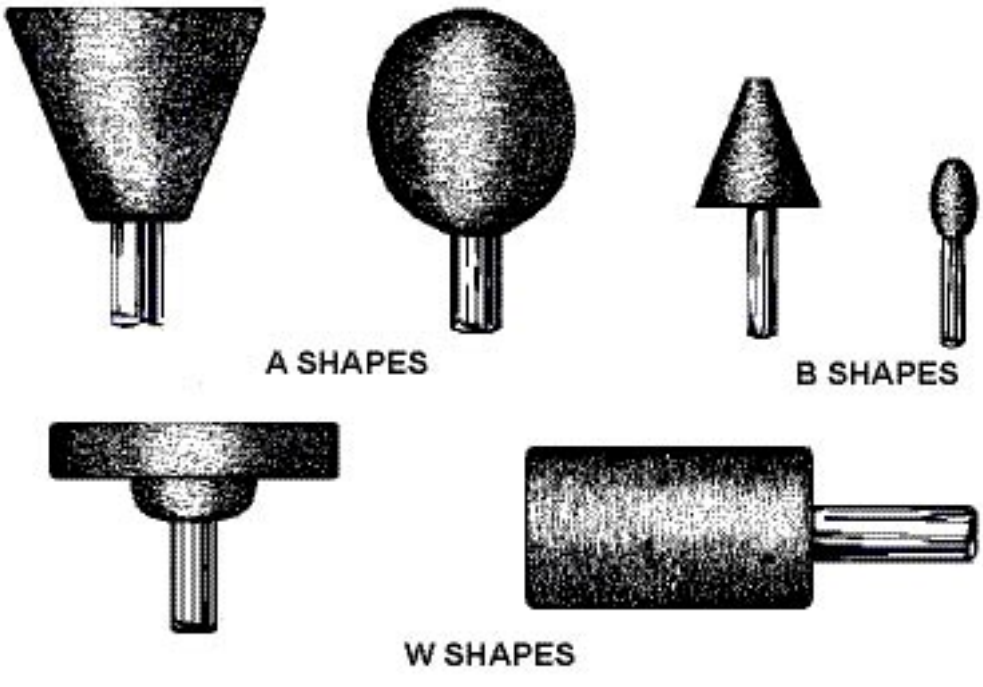
Abrasive Wheel Illustrations - Wheels

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

Mounted wheels

Bonded abrasive wheels of various shapes, usually 2 inches diameter or smaller, that are secured to plain or threaded steel mandrels.



MOUNTED WHEELS

-Continued-

Abrasive Wheel Illustrations - Flanges

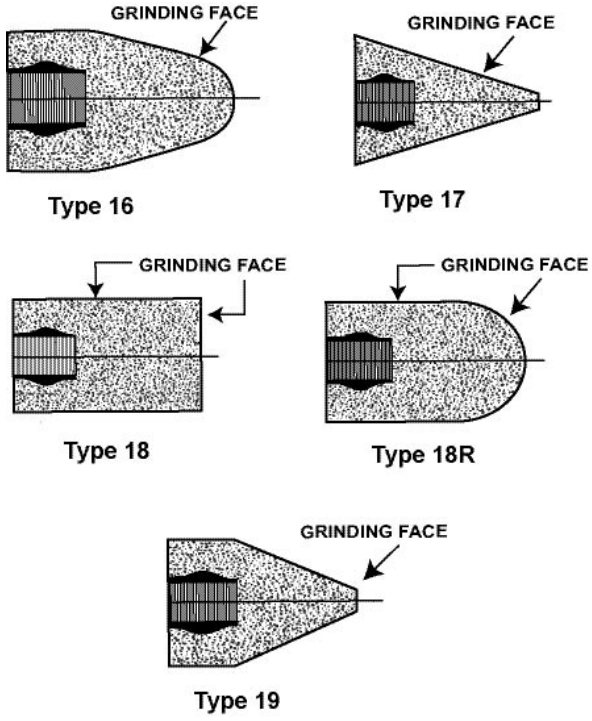
Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Wheel Types (continued)

Cone and plug wheels (Types 16, 17, 18, 18R, and 19)

Abrasive wheels manufactured with blind hole threaded bushings. They may be used on all surfaces except the flat mounting surface (D). Specific characteristics of the different cone and plug wheels are:

- Type 16 cone wheels have a curved side with a nose radius
- Type 17 cone wheels have straight sides with or without a nose radius
- Type 18 and 18R plug wheels are cylindrical in shape with either a square or curved grinding end
- Type 19 cone wheels are a combination of cone and plug shapes



Cone and Plug Wheels

-Continued-

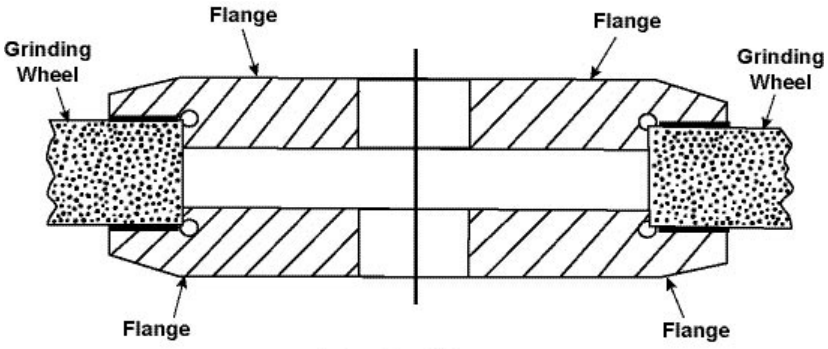
Resources

Abrasive Wheel Illustrations - Flanges

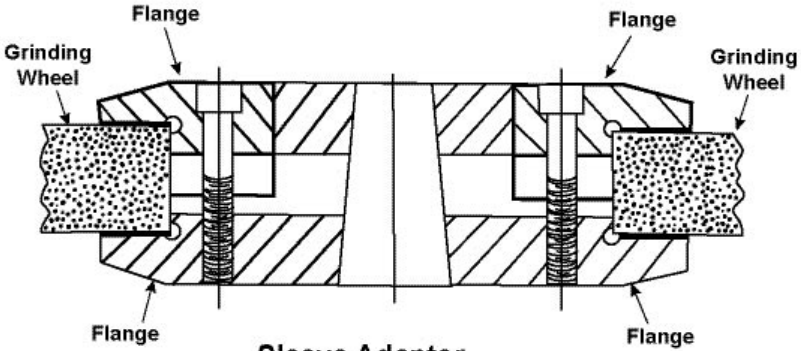
Flanges

Collars, discs or plates between or against which wheels are mounted. There are four types of flanges:

- Adaptor
- Sleeve adaptor
- Straight relieved
- Straight unrelieved



Adaptor Flange



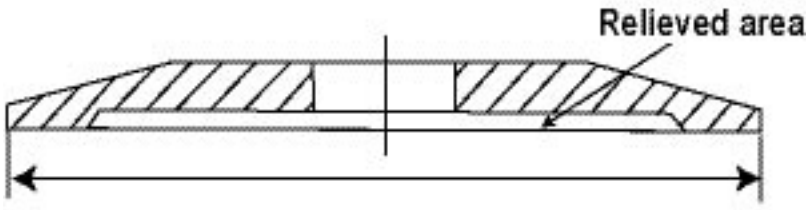
Sleeve Adaptor Flange

-Continued-

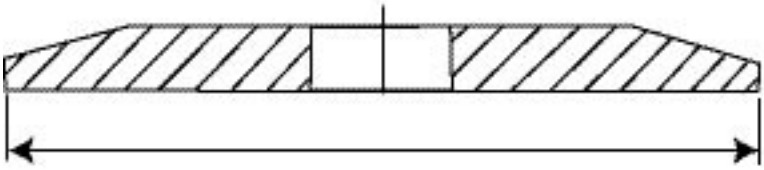
Abrasive Wheel Illustrations - Flanges

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations - Flanges (continued)



A Straight relieved flange



B Straight unrelieved flange

-Continued-

Abrasive Wheel Illustrations - Flanges

Abrasive Wheel Illustrations - Flanges (continued)

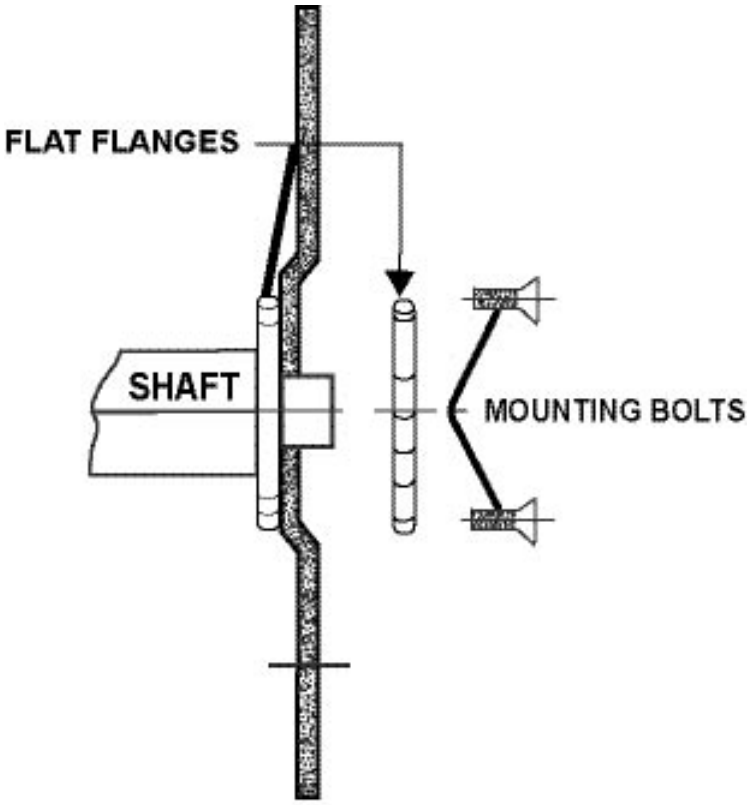
Mounting Type 27A cutting-off wheels

Type 27A cutting-off wheels are mounted between flanges that are:

- Flat (unrelieved) with matching bearing surfaces

  and

- At least 1/4 the wheel diameter



Mounting Type 27A
Cutting-off Wheels

-Continued-

Abrasive Wheel Illustrations - Flanges

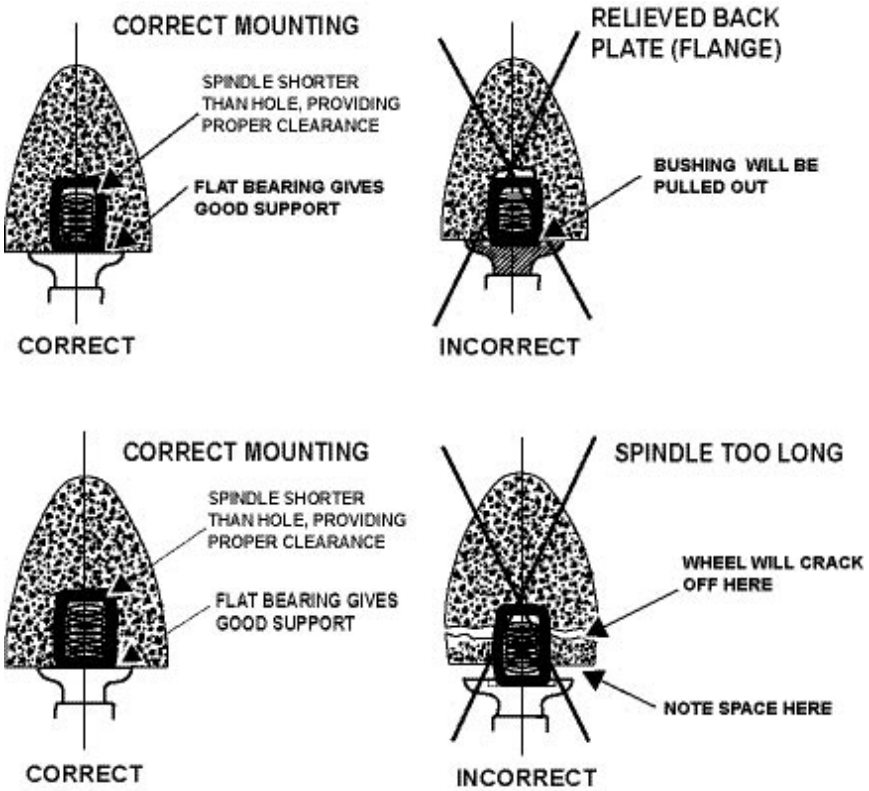
Use with Machine Safety, Chapter 296-806 WAC

(continued)

Mounting threaded hole wheels

Threaded hole wheels are mounted against a back flange that is:

- Flat (unrelieved)
- Securely fastened and square to the spindle axis
- Able to properly support the wheel



Resources

Abrasive Wheel Illustrations

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations – Maximum Exposure Angles

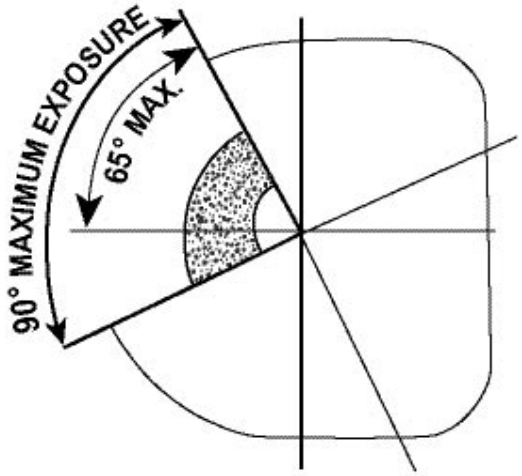
The following illustrations provide a visual reference for many of the guarding requirements for specific types of machines. Descriptions beneath the illustrations sometimes include specific application requirements.

-Continued-

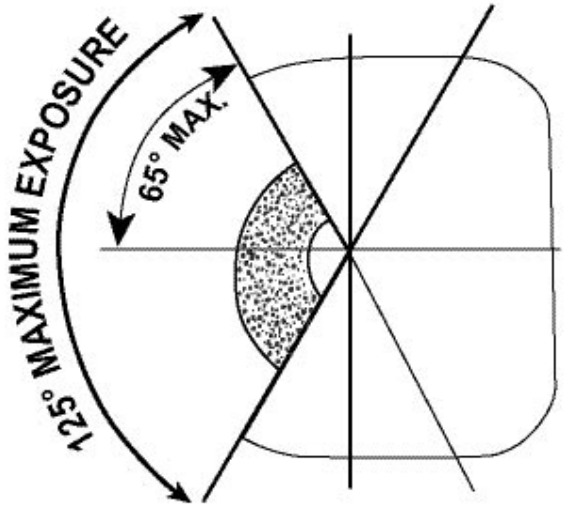
Abrasive Wheel Illustrations

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations – Maximum Exposure Angles (continued)



Bench, pedestal, and floorstand grinders



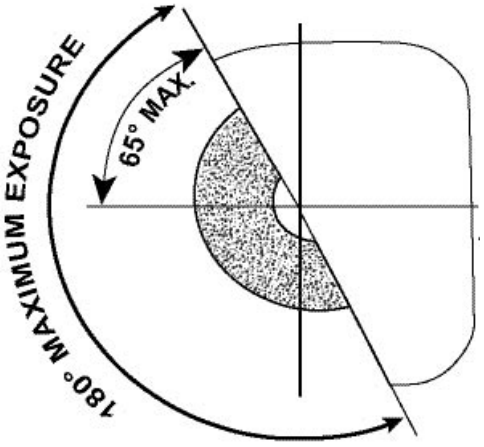
Bench, pedestal, and floorstand grinders with contact below the level of the spindle

-Continued-

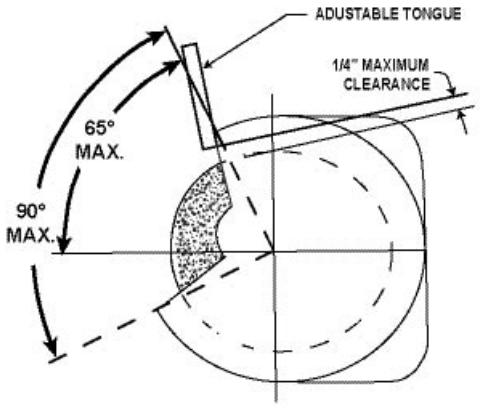
Abrasive Wheel Illustrations

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations – Maximum Exposure Angles (continued)



Cylindrical grinder



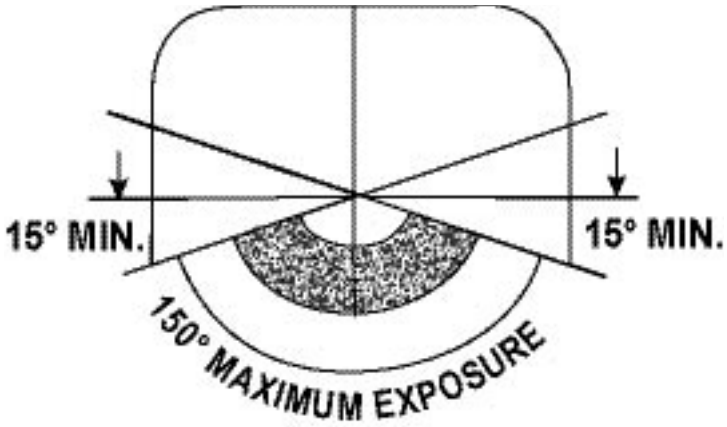
Bench, pedestal, floorstand, and cylindrical grinder exposure angle adjustment

-Continued-

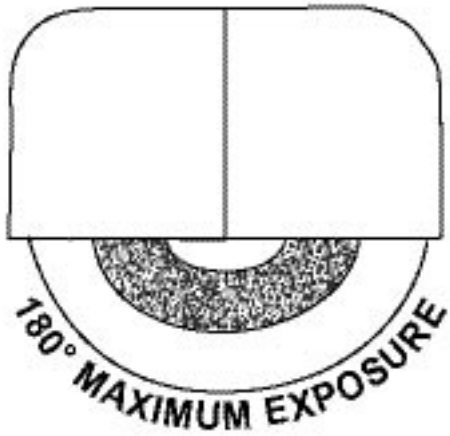
Abrasive Wheel Illustrations

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations – Maximum Exposure Angles (continued)



Surface grinders and cutting-off machines



Swing frame grinders

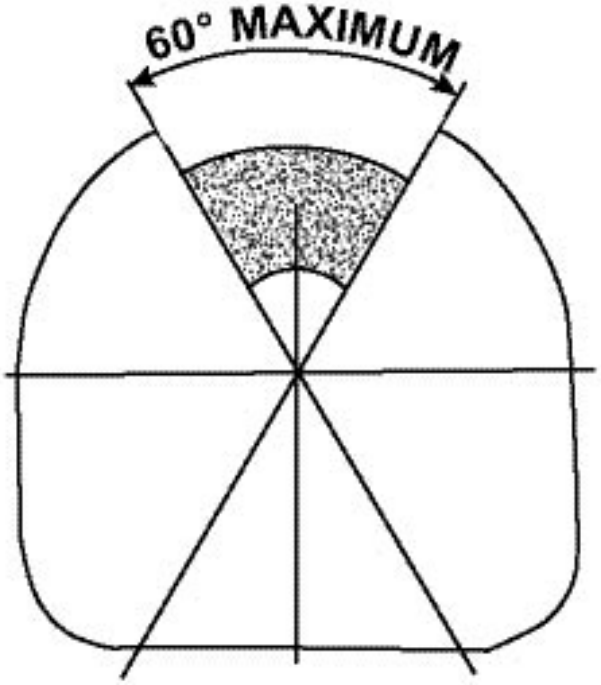
-Continued-

Resources

Abrasive Wheel Illustrations

Use with Machine Safety, Chapter 296-806 WAC

Abrasive Wheel Illustrations – Maximum Exposure Angles (continued)



Top grinding

Calender Emergency Stopping Distance

Use with Machine Safety, Chapter 296-806 WAC

This tool will allow you to determine if your calender meets the emergency stopping distance required by the rule. The size or arrangement of the rolls doesn't matter--they all have to stop within the specified limits unless there is no employee exposure to the hazard.

- You need to know the roll surface speed to use the chart. The roll surface speed is the distance (in feet) a point on the peripheral surface of the roll travels in one minute. You can determine the roll surface speed as follows:

  Roll Surface Speed (feet per minute) = .262 x Roll Diameter (inches) x rpm

  Examples:

  - 24-inch diameter roll, 15 revolutions per minute.
    Roll surface speed = .262 X 24 X 15 = 94.32 feet per minute
  - 12-inch diameter roll, 40 revolutions per minute.
    Roll surface speed = .262 X 12 X 40 = 125.76 feet per minute

Step 1: Find the roll surface speed (in feet per minute) on the horizontal axis of the chart (on the bottom).

Step 2: Draw a vertical line from the roll surface speed until it meets the sloped line between the shaded and un-shaded areas of the chart.

Step 3: Draw a horizontal line from that point to the vertical axis (on the left side) and read the maximum acceptable stopping distance.

Examples:

- A calender has a no-load roll surface speed of 125 feet per minute.
  The maximum stopping distance allowed is $26\frac{1}{2}$ inches
- A calender has a no-load roll surface speed of 100 feet per minute.
  The maximum stopping distance allowed is 21 inches.

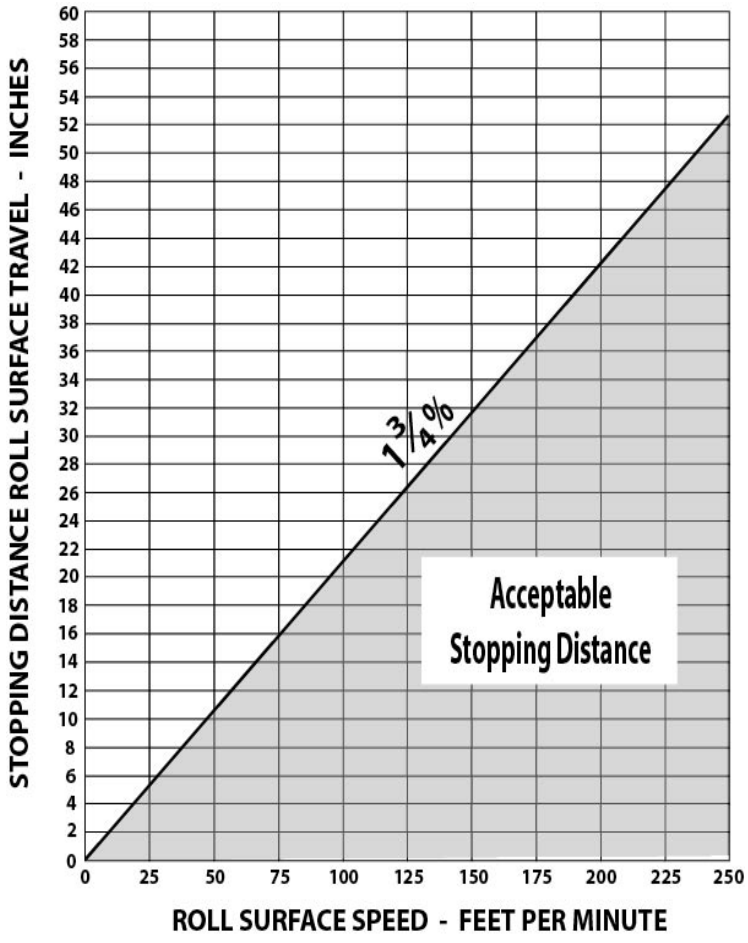
Calender Emergency Stopping Distance

Use with Machine Safety, Chapter 296-806 WAC

Calender Stopping Distances Chart

The shaded area of the chart below shows acceptable stopping distances for calenders. These distances are measured:

- With the rolls running empty at maximum operating speed.
- In inches of roll surface traveled
- From the instant the emergency stopping device is activated.



Mill Emergency Stopping Distance

Use with Machine Safety, Chapter 296-806 WAC

This tool will allow you to determine if your mill meets the emergency stopping distance required by the rule. The size or arrangement of the rolls doesn't matter--they all have to stop within the specified limits unless there is no employee exposure to the hazard.

- You need to know the roll surface speed to use the chart. The roll surface speed is the distance (in feet) a point on the peripheral surface of the roll travels in one minute. You can determine the roll surface speed as follows:

  Roll Surface Speed (feet per minute) = .262 x Roll Diameter in Inches x rpm

  Examples:

  - 24-inch diameter roll, 15 revolutions per minute.
    Roll surface speed = .262 X 24 X 15 = 94.32 feet per minute
  - 12-inch diameter roll, 40 revolutions per minute.
    Roll surface speed = .262 X 12 X 40 = 125.76 feet per minute

Step 1: Find the roll surface speed (in feet per minute) you calculated in Step 1 on the horizontal axis of the chart (on the bottom).

Step 2: Draw a vertical line from the roll surface speed until it meets the sloped line between the shaded and un-shaded areas of the chart.

Step 3: Draw a horizontal line from that point to the vertical axis (on the left side) and read the maximum acceptable stopping distance.

Examples:

- A mill has a no-load roll surface speed of 125 feet per minute.
  The maximum stopping distance allowed is $22\frac{1}{2}$ inches
- A mill has a no-load roll surface speed of 100 feet per minute.
  The maximum stopping distance allowed is 18 inches.

-Continued-

Mill Emergency Stopping Distance

Use with Machine Safety, Chapter 296-806 WAC

Mill Stopping Distances Chart (continued)

Acceptable stopping distances for mills are those less than or equal to 1-1/2 % of the fastest speed at which they operate when empty. The size or arrangement of the rolls doesn't matter--they all have to stop within the specified limits unless safety guarding eliminates employee exposure to the hazard.

The shaded area of the chart below shows stopping distances that are acceptable for Mills. These distances are measured:

- With the rolls running empty at maximum operating speed.
- In inches of surface travel of the roll.
- From the instant the emergency stopping device is activated